the winds from the rain quarter, or, in other words, upon the rate of movement of the atmospheric disturbance with which the rain winds are associated.

3. The altitude of the zone of maximum precipitation appears to vary slightly with latitude, being lowest in the Tropics—a little less than 1,000 meters—and highest in temperate latitudes, say, between 1,400 meters and 1,500 meters. It has also a seasonal variation, being highest in summer and lowest in winter.[10]

ALTITUDE RELATIONS OF RAINFALL IN FRANCE.

By E. MATHIAS.

[*Abstract:* "La pluie en France, etc." C. R. Paris Acad., 1919, 168: 105-108; 239-242.]

The precipitation-altitude relation in France may be expressed closely with the formula, $R=R_1+kA-k'A^2$, in which R represents the rainfall in millimeters at altitude A (in meters), R_1 the rainfall at a lowland station, k the coefficient of increase with altitude, and $k'A^2$ a term to take care of the decrease of rainfall above a certain elevation. For the Puy du Dome, and probably for the rest of France, k' is 1/20,000; thus, the formula becomes, $R=R_1+kA-\frac{1}{2}(A/100)^2$. On a map of France the author shows the values of k for each Department. k varies uniformly with latitude, ranging from 0.5 in the Pyrenees (lat. 43°) to 1.2 in the north (lat. 50°).—C. F. B.

THE CONSERVANCY WEATHER AND FLOOD WARNING SERVICE.

[From The Miami Conservancy Bulletin, Dayton, Ohio., Jan., 1919, vol. 1, No. 6, pp. 93-94.]

During the construction of the flood-prevention works it is of vital necessity that the District be informed as much in advance as possible of even slight flood stages in the river. There is much construction equipment, such as drag lines, railway tracks, locomotives, pumps, and motors, which must be used in or near the river bottoms, and failure to protect it from floods would mean very serious loss and delays. It also is desirable that the people of the valley receive all possible advance notice of any floods that may occur before the flood prevention works are completed, so that they may not again be taken unawares as in 1898 or 1913.

Perceiving the necessity of this, the Conservancy District in 1913 established a flood-warning service, under the direction of Mr. Ivan E. Houk. At that time there were only 15 stations in the Miami watershed where accurate measures of rainfall were made, and only three where careful measures of the river stages were made. Steps were at once taken, in cooperation with the United States Weather Bureau, to increase the number of these stations. The Government and the District together established four new combined rainfall and river stations; the District alone established eight combined stations and 13 river stations; and the Weather Bureau alone established 10 new rainfall stations. Thus the river stations were increased from 3 to 25 and the rainfall stations from 15 to 37. These are scattered throughout the Miami Valley, and by means of daily observations a close watch is kept on river stages and rainfall. In ordinary weather these observations are transmitted weekly to the district forecaster, but in times of storm or impending flood they are sent in by telephone or telegraph as often as is necessary. The forecaster may have to get up at midnight or at 1 or 2 o'clock in the morning to receive them and, in turn, to arouse the Conservancy engineers and other people whose property may be threatened.

The flood-warning service is as valuable in preventing unnecessary expense and alarm as it is in giving alarm when danger really impends. The memory of the 1913 flood is still fresh in people's minds. On January 31 and March 27, 1916, for instance, when the weather and river conditions seemed ominous, many would have moved out of their houses, farmers would have moved their livestock, construction companies their equipment, and merchants their stocks of goods, if they had not been assured that such steps were unnecessary. On the first of these dates two of the Conservancy engineers devoted their entire time all through the day and following night to answering telephone calls regarding river conditions. Two men of the United States Weather Bureau were also on duty from early morning until late at night answering such calls, which totaled about 1,600 in number. These inquiries came from all parts of the valley, from Piqua on the north to Hamilton on the south. At the same time an engineer experienced in flood fighting was sent to each of the cities where conditions seemed dangerous, to work with the local officials in taking such steps as might be necessary.

An instance of the value of such service in property conservation is the case of the Esterline Co., of Lafayette, Ind. This company had only 4 or 5 hours' notice of the flood in 1913, but in that time it moved from its buildings about $100,000 worth of merchandise, and all of its records, office furniture, and fixtures. The belting was removed from the machinery, which was then heavily coated with grease. By these precautions the company prevented an estimated loss of $60,000.

It is evident that such a service may well be the means of saving life as well as property by warning people who live on low ground to move when dangerous floods impend.

It will be clear from what has been said that the service of the flood-warning bureau is of great value, both to the Conservancy district in its work and to the people of the valley, and that compared with its value it is very inexpensive. A considerable part of this expense, moreover, is borne by the Federal Government.[1]

ADDITIONAL NOTE.

By R. FRANK YOUNG, Meteorologist.

[Dated: Weather Bureau, Dayton, Ohio, Feb. 10, 1919.]

The Miami River at Dayton has not reached the flood stage since the destructive flood of March 25–28, 1913, the nearest approach to flood since the latter date being on January 31, 1916, when it reached a stage of 14.7 feet.

The flood stage at Dayton is 18 feet, but as the levees afford protection to about 5 feet above this there is no real danger to the city till the water rises above 22 feet. It has been the experience of the Weather Bureau office, however, that a period of unusually heavy rains, with a rise to 12 feet or above causes much anxiety among the people living in the lower districts, and this may easily develop into something approaching a panic by the spreading of false rumors as to warnings. The telephone is, of course, an indispensable means of disseminating information at such a time, but in some instances the two telephones in use proved wholly inadequate to meet the

[10] A very comprehensive discussion of the precipitation-altitude relation for the British Isles will be found in a paper by Salter, C. The Relation of Rainfall to Configuration. (London Institution of Water Engineers. 1918, 37 pp., 2 pl.)

[1] See also, W. A. Drake, "The Miami Conservancy Flood Prevention Plan," Sci. Am., Mar. 22, 1919, pp. 282-283, 299-300, 5 figs.

requirements, and it is most likely that the fact that many people were unable to get in communication with this office tended to increase the excitement. The best means of meeting a situation of this kind is the issue of a short bulletin on the ordinary forecast card, which is given wide distribution in the city by mail carrier in the early morning delivery or in the afternoon, as conditions warrant. By multigraph process 2,000 or more of these bulletins can be prepared in a few minutes. In this way we have been able to reach the public more effectually than by telephone, and to do so several hours before the afternoon papers are issued.

It is exceedingly difficult to give timely warnings of floods in a river the size and character of the Miami because of the short interval of time between rainfall and the resulting crest stage in the river, which is approximately 12 hours in the upper and 18 hours in the lower stream. This was most clearly brought out in July, 1915. A heavy rainstorm occurred over the watershed on July 7, most of the rain falling between 8 p. m. and midnight. The crest stage from this rain was reached at Piqua, 40 miles above Dayton, about 11 a. m. of the 8th, and the river at Dayton had risen to within a foot of the highest stage by 2 p. m. of the 8th, although it continued to rise slowly till about midnight.

GENERAL CLASSIFICATION OF METEOROLOGICAL LITERATURE.

By Charles F. Brooks, Meteorologist.

[Dated: Weather Bureau, Washington, Mar. 5, 1919.]

The following general classification of meteorological literature was evolved for the purpose of having a logical, simple, and easily remembered system for filing notes, pamphlets, and references. It is the outgrowth of the use of the Dewey Decimal System, of that in the International Catalogue of Scientific Literature (section F, Meteorology), and, finally, of a decimalized edition of the latter proposed by the late Eleanor Buynitzky of the Weather Bureau Library.[1] For an individual, the Dewey Decimal System is unduly detailed and cumbersome. To use this system it is necessary to refer to the classification and its index constantly while filing material. Furthermore, for appropriate space for the important new developments of meteorology the original classification was made too long ago. The International Catalogue has plenty of detail, but the numbers are very difficult to remember. The decimalized modification of it is not easy to remember, and it is somewhat difficult to use on such important subjects as winds, and effects of the weather.

Therefore, I have tried to make a classification with fewer divisions, especially in those parts of the subject where single papers (e. g. winds) usually cover several of the more refined divisions of classifications now in use. Subheadings can be made to suit individual requirements of those who may use this system. The order is in most respects the same as that shown in the outline on page 559 of the December, 1918, Review. This classification is now in use in handling current material for the Monthly Weather Review.

[1] Mo. Wea. Rev., 1915, 43: 362-364: review, Science, Feb. 11, 1916, p. 216.

GENERAL CLASSIFICATION OF METEOROLOGICAL LITERATURE.

00 General.
- 01 History. Biography.
- 02 Bibliographies, general treatises, textbooks, glossaries.
- 03 Periodicals. Reports of societies, etc.
- 04 Miscellaneous addresses, articles, and notes.
- 05 Teaching and research.

10 Observation.
- 11 Methods of observation. Work of observatories and weather services.
- 12 Kite and balloon stations and methods.
- 13 Radiation and temperature measurement.
- 14 Pressure measurement.
- 15 Wind and cloud movement observation.
- 16 Moisture measurement.
- 17 Meteorographs. Miscellaneous.
- 18 Tables for reductions.
- 19 Applications of mathematics.

20 Air.
- 21 Composition and extent of the atmosphere.
- 22 Thermodynamics of air.
- 23 Miscellaneous properties of air as a gas.
- 24 Acoustics.
- 25 Optics.
- 26 Atmospheric electricity.
- 27 Lightning.
- 28 Aurora. Magnetic storms.

30 Temperature.
- 31 Solar radiation.
- 32 Atmospheric scattering, absorption, and radiation.
- 33 Land-surface absorption, radiation, and temperature.
- 34 Water-surface absorption, radiation, and temperature.
- 35 Effect of surface on air temperature.
- 36 Vertical distribution of temperature.
- 37 Geographical distribution of temperature.

40 Pressure.
- 41 Vertical decrease of pressure and density. Hypsometry.
- 42 Pressure reduction to stated levels, for map making.
- 43 Pressure changes.
- 44 Wind pressure.
- 45 Geographical distribution of pressure.

50 Wind.
- 51 Convectional circulation. Local winds due directly to heating or cooling.
- 52 Vertical convectional currents in the free air.
- 53 Gradient (frictionless) wind. Actual wind.
- 54 Influence of the earth's surface on wind velocity and direction; turbulence.
- 55 Over- and under-running of winds. Wind billows.
- 56 General circulation of the atmosphere.

60 Moisture.
- 61 Evaporation. Humidity.
- 62 Dew and frost.
- 63 Condensation nuclei.
- 64 Fog. Fog ice deposits.
- 65 Cloud forms and their genesis.
- 66 Precipitation in general: causes, fluctuations, distribution.
- 67 Snow, sleet, rain, hail: characteristics, causes, and distribution of each.

70 Weather.
- 71 Weather abnormalities: changes in "grand centers of action."
- 72 Tropical cyclones.
- 73 Extra-tropical migratory cyclones and anticyclones considered as units: origin and maintenance, general characteristics, movement and paths.
- 74 Distribution of meteorological elements about and in cyclones and anticyclones.
- 75 Local storms: thunderstorms, squalls, tornadoes, and waterspouts.